Liebert® Prop Fan Condensing Unit™

User Manual—50 & 60Hz

EMERSON™
Network Power

Figure i Model number nomenclature

Example: PFH037A-PL7

PFH	0	37	A	—	P	L	7
Prop Fan Condensing Unit with Hot-Gas Bypass	0 = Standard Noise Level Z =Quiet-Line	Nominal Capacity 1000 BTU/Hr	A = Air Cooled	— = Standard Coil C = Coated Coil	P = 208/230-1ph-60Hz Y = 208/230-3ph-60Hz A = 460-3ph-60Hz B = 575-3ph-60Hz S = 220-1ph-50Hz M = 380/415-3ph-50Hz	L = 95°F (35°C) Ambient Liebert Lee-Temp H = 105°F (41°C) Ambient Liebert Lee-Temp	R-407C Refrigerant

Not all options and/or voltage combinations are available.

TABLE OF CONTENTS

FIGURES

TABLES

1.0 Product Description

1.1 Prop Fan Condensing Units

Liebert® propeller fan condensing units are available in a range of sizes and configurations to offer flexibility in designing a precision environmental control system. The appropriate propeller fan condensing unit paired with a corresponding Liebert fan coil evaporator model such as Liebert DataMate™, Liebert Mini-Mate2™ or Liebert Challenger 3000™ is an effective solution for your environmental control application requirements.

Split system condensing units are connected to the evaporator unit by two refrigerant lines (four in 8-ton systems) and a low-voltage control cable. The condensing unit requires a separate power source and power disconnect switch.

1.1.1 Base System 95°F (35°C) Ambient Models

The heart of the refrigeration system is a quiet, high efficiency scroll compressor with internal vibration isolation mountings, pressure safety controls and built-in overload protection. Standard features include crankcase heater, high-pressure switch, condenser coil, sight glass, filter drier, hot gas bypass system with liquid quenching valve, direct drive propeller fan and motor, and Liebert Lee-Temp™ flood-back head pressure control. These models are designed to provide catalog capacity of the appropriate evaporator section up to 95°F (35°C) outside ambient temperature.

1.1.2 105°F (41°C) Ambient Models

These models contain similar components to the base models except the coils and fans are sized to provide catalog capacity of the appropriate evaporator section up to 105°F (41°C) outside ambient temperature.

1.1.3 Liebert Quiet-Line™ Models

These models contain similar components to the base models except the coils and fans are sized to provide catalog capacity of the appropriate evaporator section up to 95°F (35°C) outside ambient temperature with a noise level of less than 58 dBA.

1.2 Optional Equipment

1.2.1 Coated Coil

This option provides a phenolic coating for the condenser coil (extended lead time is required for this option; consult factory).

Pre-Charged Refrigeration Line Sets

For efficient condenser/evaporator connection, factory pre-charged line sets with quick connect fittings are available in 15-ft. and 30-ft. (4.5m and 9m) lengths. Each set includes an insulated copper suction line and copper liquid line, both charged with R-407C refrigerant and sealed. Line sets are only available for 1 to 3.5 Ton Units.

1.2.2 Refrigerant Line Sweat Adapter Kit

This kit includes the compatible fittings required (two for the insulated suction line and two for the liquid line) when using field-supplied interconnecting refrigerant lines instead of the pre-charged line sets.

1.2.3 277V Step-Down Transformer

A 37.5A, 277V step-down transformer is available for 1-to 3-Ton 60Hz condensing units needing 277/1/60 input power. Apply this transformer to a 208/230/1/60 condensing unit. The transformer is coated with epoxy and contained in an enclosed, non-ventilated electrical box with adaptable mounting brackets.

2.0 INSTALLATION

Read this entire installation section before starting installation. This section details dimensional, electrical and piping information and specifications that affect the placement of the PFH unit in relation the connected evaporator unit, other outside units, barriers and walls.

Be particularly mindful of service and airflow clearances and maximum equivalent piping distances and in elevation differences between PFH and connected evaporator unit. Consult and confirm applications with your Emerson Network Power representative when applications exceed any of these specifications.

2.1 Equipment Inspection

When the unit arrives, inspect all items for any visible or concealed damage. Report any damage to the carrier immediately and file a damage claim; send a copy of the claim to Emerson Network Power or your local Emerson sales representative.

If possible, maintain equipment and packaging until it is at the installation location.

2.2 Location Considerations

To ensure an adequate air supply, locate all condensing units in a clean-air area, away from loose dirt and debris that can clog the coil. Avoid ground-level sites with public access or areas that are exposed to heavy snow accumulation. Locate unit to allow maximum security and maintenance accessibility.

Do not locate condensing units near steam, hot air or fume exhausts. Do locate units at least 18 in. (457mm) from walls, obstructions or adjacent units. For multiple unit installations, space unit so that the hot condenser exhaust air is not directed toward the condenser air inlet of an adjacent unit.

Install a solid base at least 2 in. (51mm) higher than the surrounding grade and 2 in. (51mm) larger than condensing unit base dimensions and capable of supporting the condenser’s weight.

2.3 Dimensional Data

Figure 1 Dimensions, horizontal air discharge

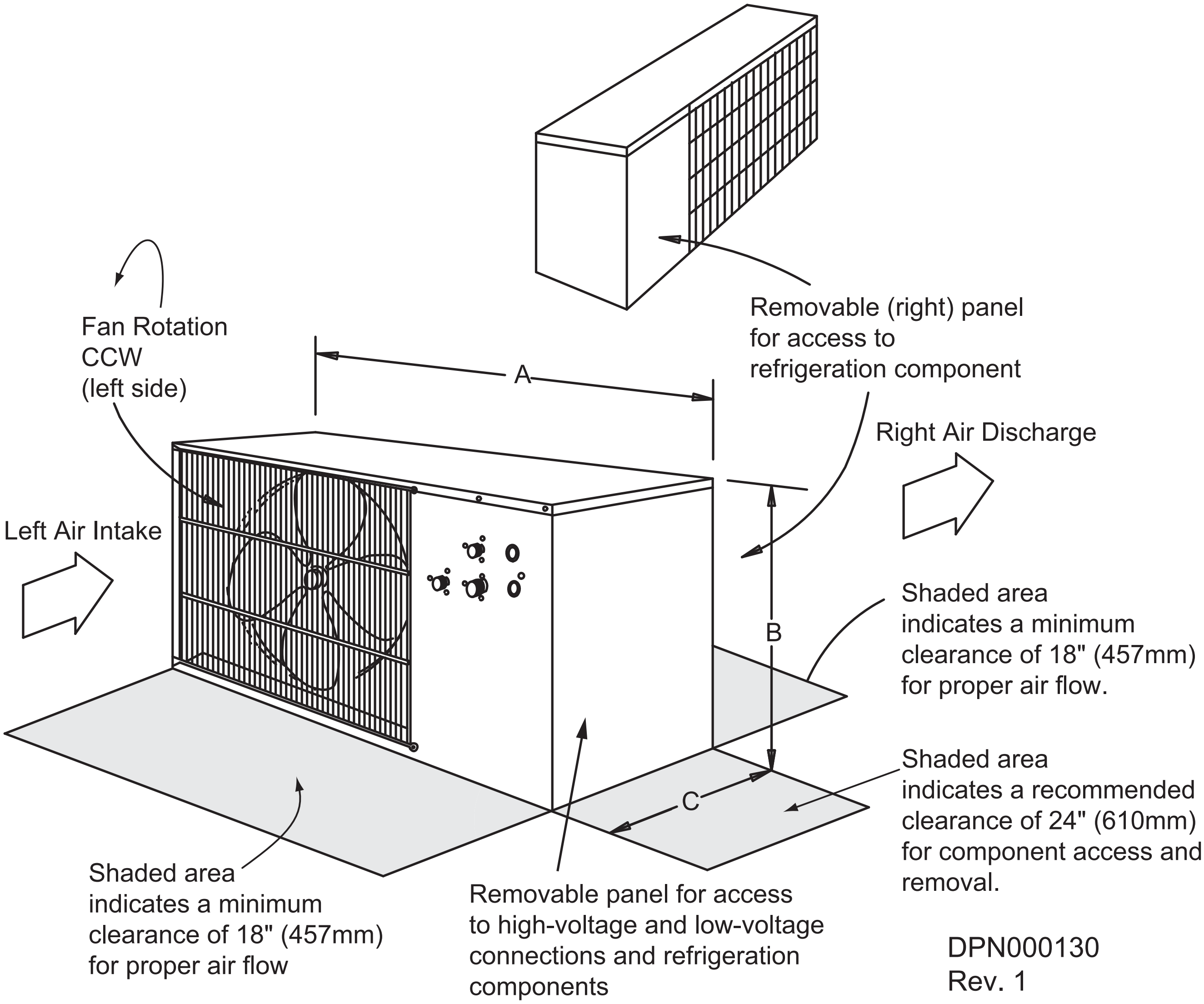


Table 1 Cabinet and floor planning data, horizontal air discharge

Model Numbers		Dimensional Data, in. (mm)			Net Weight lb. (kg)
60Hz	**50Hz**	**A**	**B**	**C**	
PFH014A-L	—	40 (1016)	23-1/2 (597)	18 (457)	200 (91)
PFH020A-L	—				
PFH027A-L	—				
PFH027A-H	—	48 (1219)	31 (787)	18 (457)	241 (109)
PFHZ27A-L	—				
PFH037A-L	PFH036A-L				
PFH042A-L	PFH041A-L				
PFH037A-H	PFH036A-H	53 (1343)	36-1/4 (918)	18 (457)	351 (159)
PFHZ37A-L	PFHZ36A-L				
PFH042A-H	PFH041A-H				
PFHZ42A-L	PFHZ41A-L				
PFH067A-L	PFH066A-L				

Source: DPN000130, Rev. 1

Figure 2 Dimensions, top air discharge

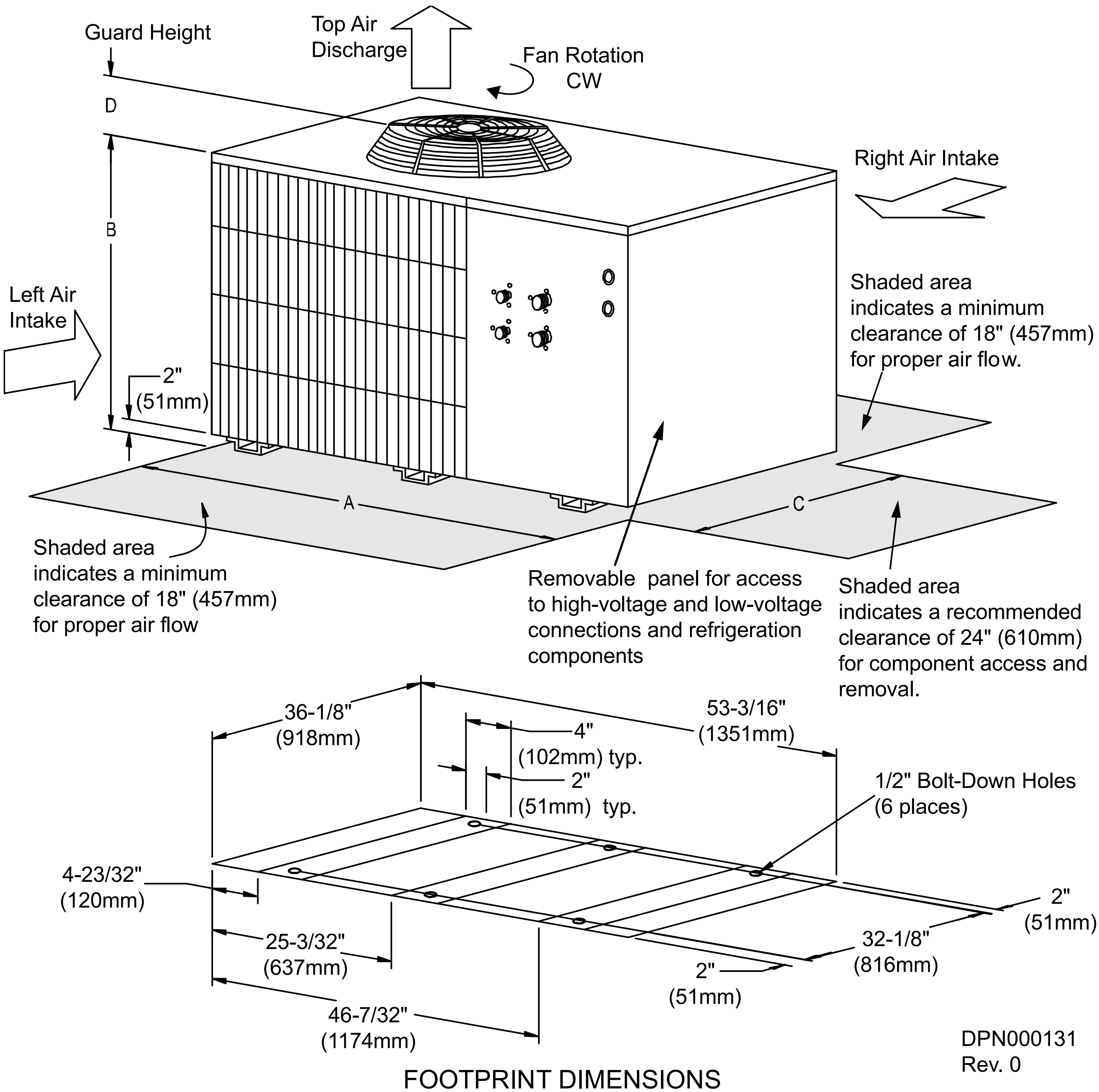
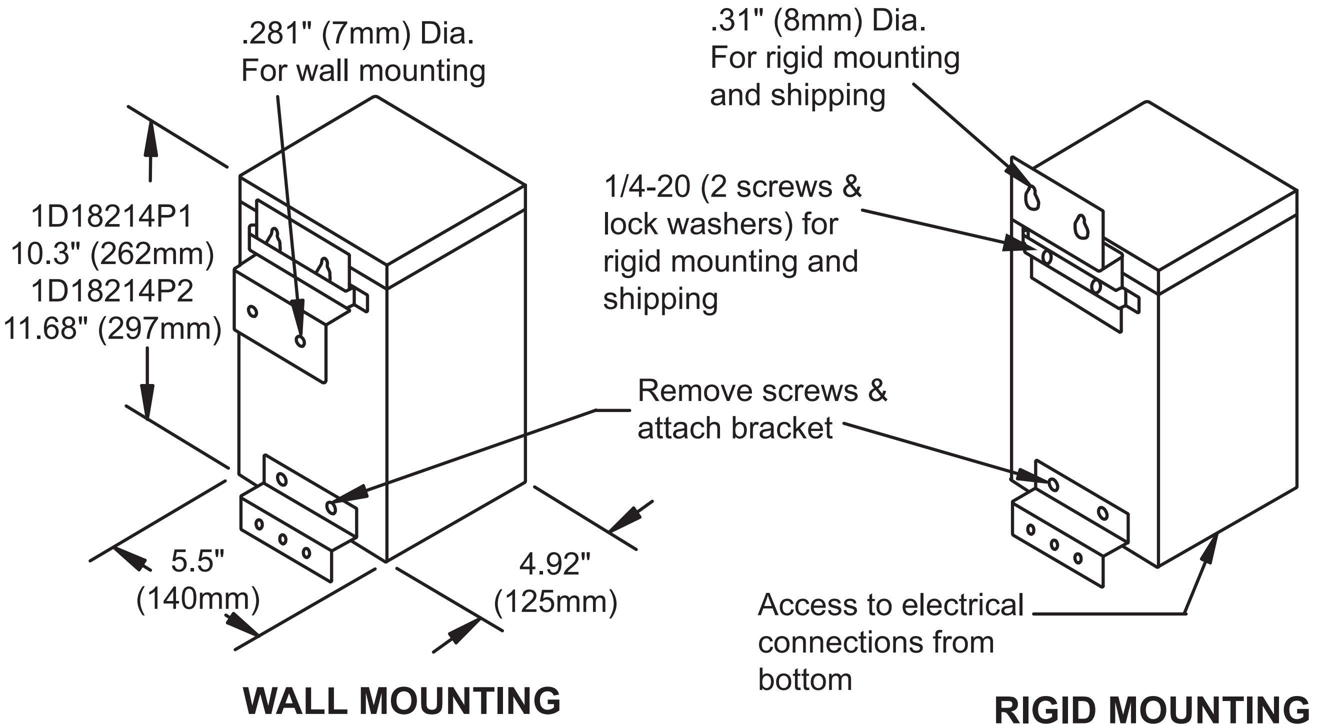


Table 2 Electrical and piping connections, top air discharge

Model Numbers		Dimensional Data in. (mm)				Module Net Weight, lb. (kg)
60Hz	50Hz	A	B	C	D	
PFH067A-H	PFH066A-H	53 (1343)	36-1/4 (918)	38-1/2 (978)	5-1/2 (140)	488 (222)
PFHZ67A-L	PFHZ66A-L					
PFH096A-L	PFH095A-L					570 (259)

Source: DPN000131, Rev. 0

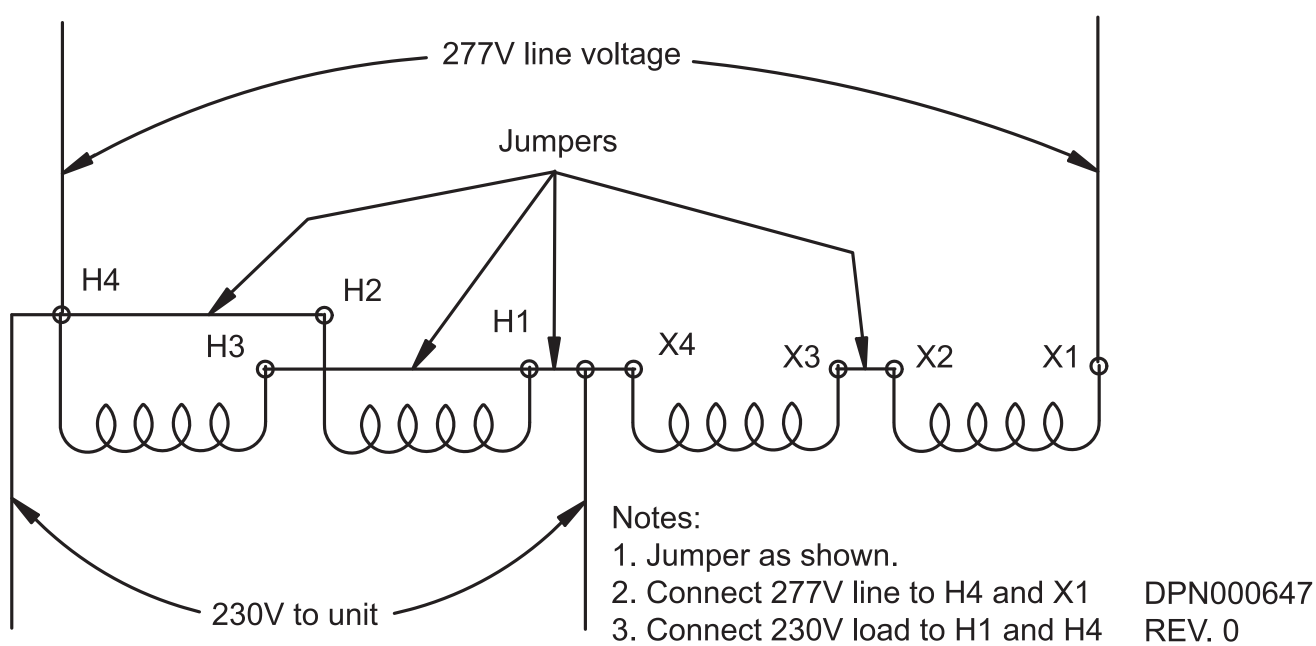
Figure 3 Dimensional data, 277V step-down transformer



Notes:

1. 1D18214P1 = Acme catalog no. T-1-37921 for all small systems except 3-ton Liebert DataMate with integral condenser.
2. 1D18214P2 = Acme catalog no. T-1-37922 for 3-ton Liebert DataMate with integral condenser.
3. Epoxy coated. Suitable for indoor/outdoor service. Horizontal- or vertical-mount. Totally enclosed, non-ventilated.
4. Both brackets are shipped loose with transformer.

WIRING FOR TRANSFORMER



2.4 Piping and Electrical Connections

Figure 4 Piping and electrical connections, horizontal discharge

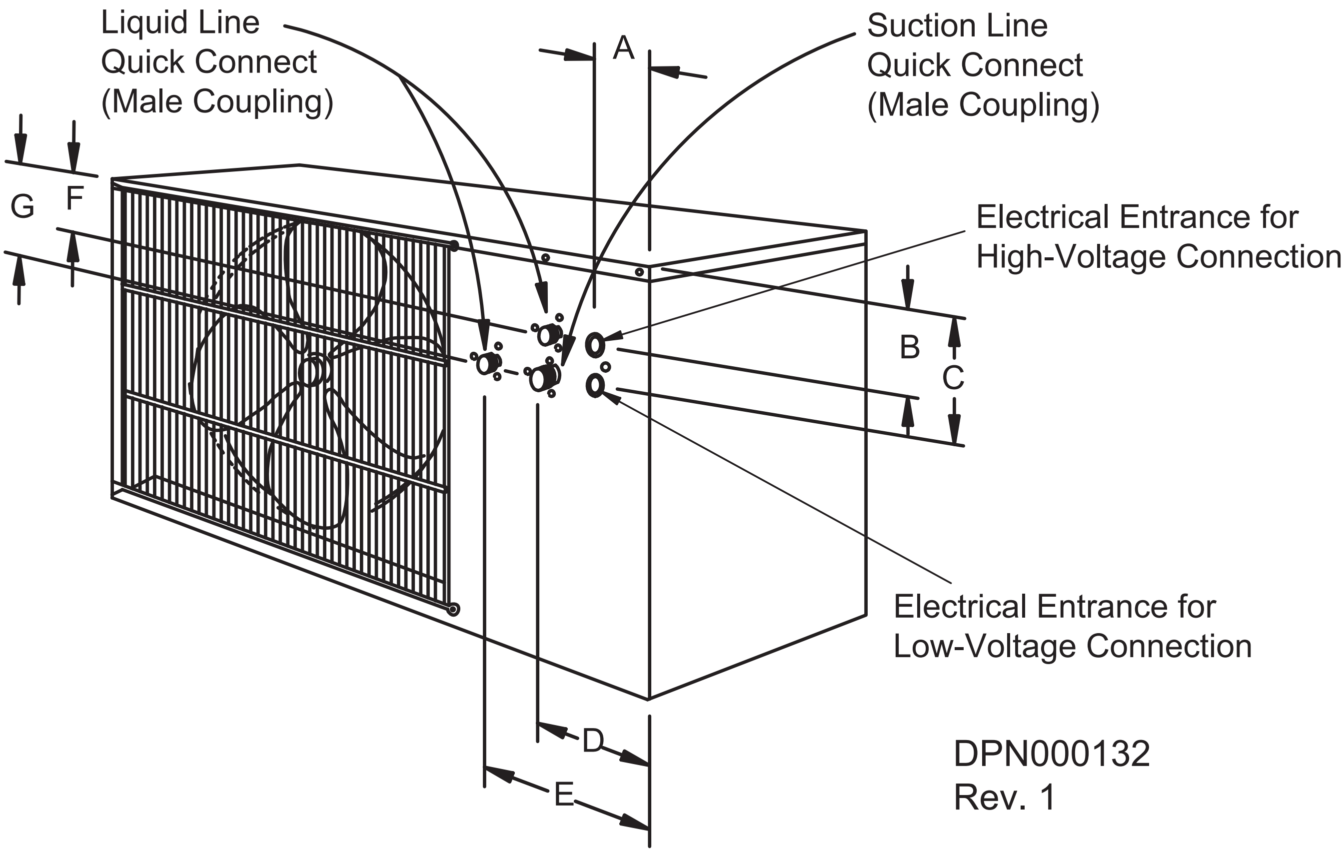


Table 3 Electrical and piping connections, horizontal air discharge

Model Numbers		Electrical Connections, in (mm)			Piping Connections, in. (mm)			
60Hz	**50Hz**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
PFH014A-L	—	2-1/4 (57)	5-1/4 (133)	7-3/4 (197)	8-3/4 (222)	—	5 (127)	7-1/4 (184)
PFH020A-L	—							
PFH027A-L	—							
PFH027A-H	—	2 (51)	5-3/4 (146)	8-1/2 (216)	4-3/4 (121)	6-3/4 (171)	—	8-1/2 (216)
PFHZ27A-L	—							
PFH037A-L	PFH036A-L							
PFH042A-L	PFH041A-L							
PFH037A-H	PFH036A-H	2 (51)	6 (152)	8-1/2 (216)	4-3/4 (121)	7-3/4 (197)	—	8-1/2 (216)
PFHZ37A-L	PFHZ36A-L							
PFH042A-H	PFH041A-H							
PFHZ42A-L	PFHZ41A-L							
PFH067A-L	PFH066A-L							

Source: DPN000132, Rev. 1

Figure 5 Piping and electrical connections, top air discharge

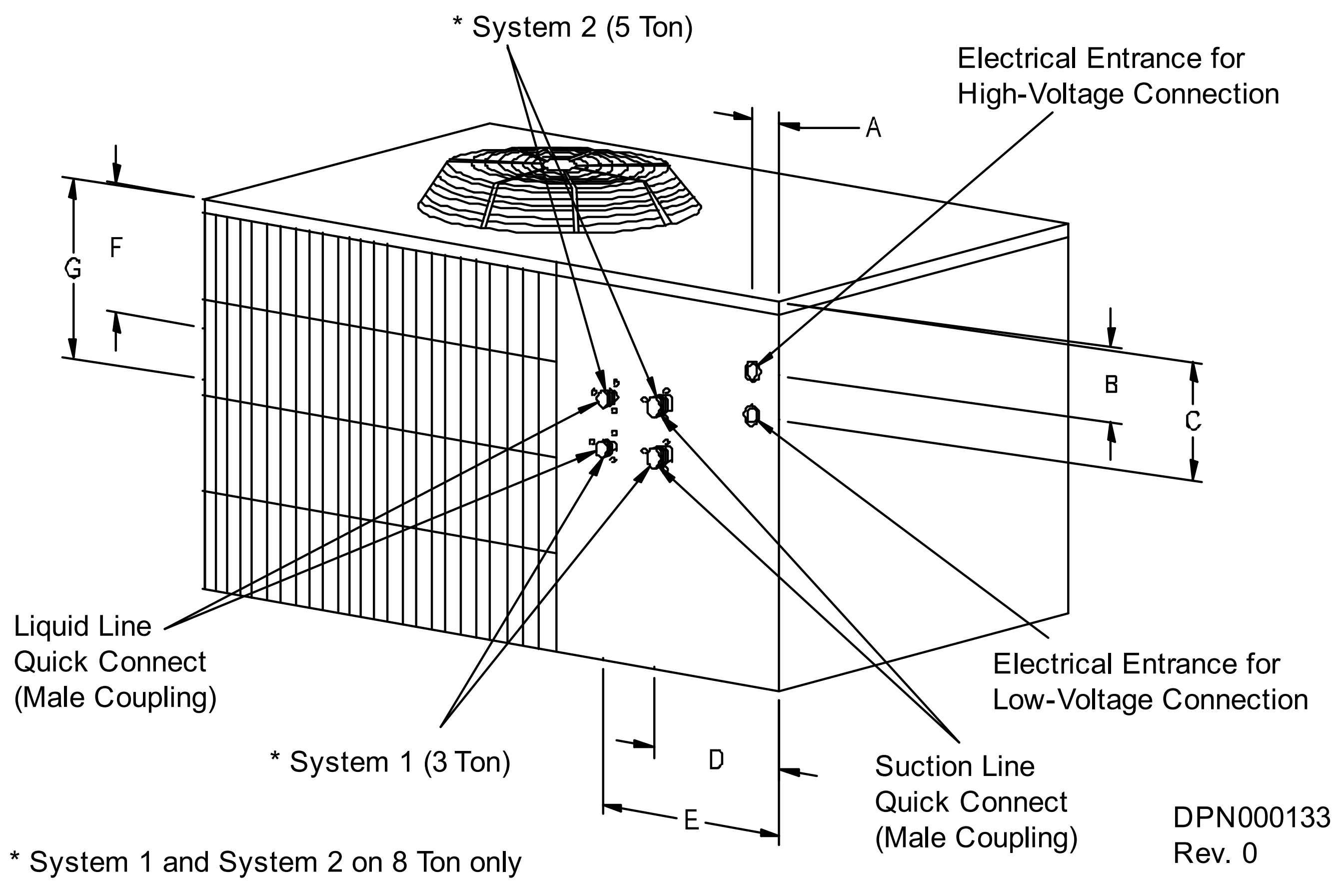
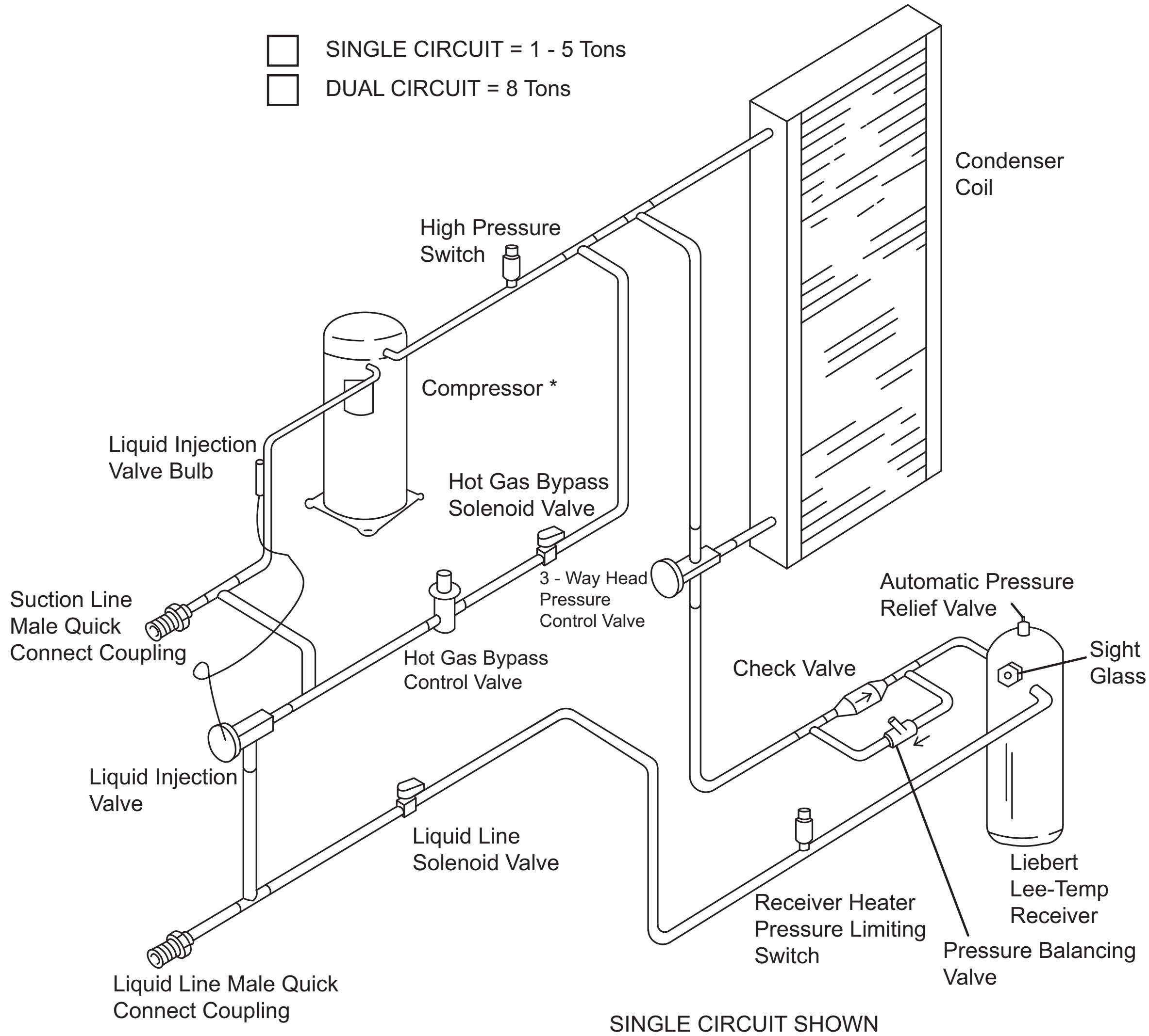


Table 4 Piping and electrical connections, top air discharge

Model Numbers		Electrical Connections in. (mm)			Piping Connections in. (mm)			
60Hz	50Hz	A	B	C	D	E	F	G
PFH067A- H	PFH066A-H	2 (51)	6 (152)	8-1/2 (216)	4-3/4 (121)	7-3/4 (197)	8-1/2 (216)	—
PFHZ67A- L	PFHZ66A-L							—
PFH096A- L	PFH095A-L							11-1/2 (292)

Source: DPN000133, Rev. 0

Figure 6 General piping arrangement



* Scroll compressor, except 1Ton, 60Hz is reciprocating compressor.

DPN000129
Rev. 3

Figure 7 Electrical field connections, 1- to 5-ton units

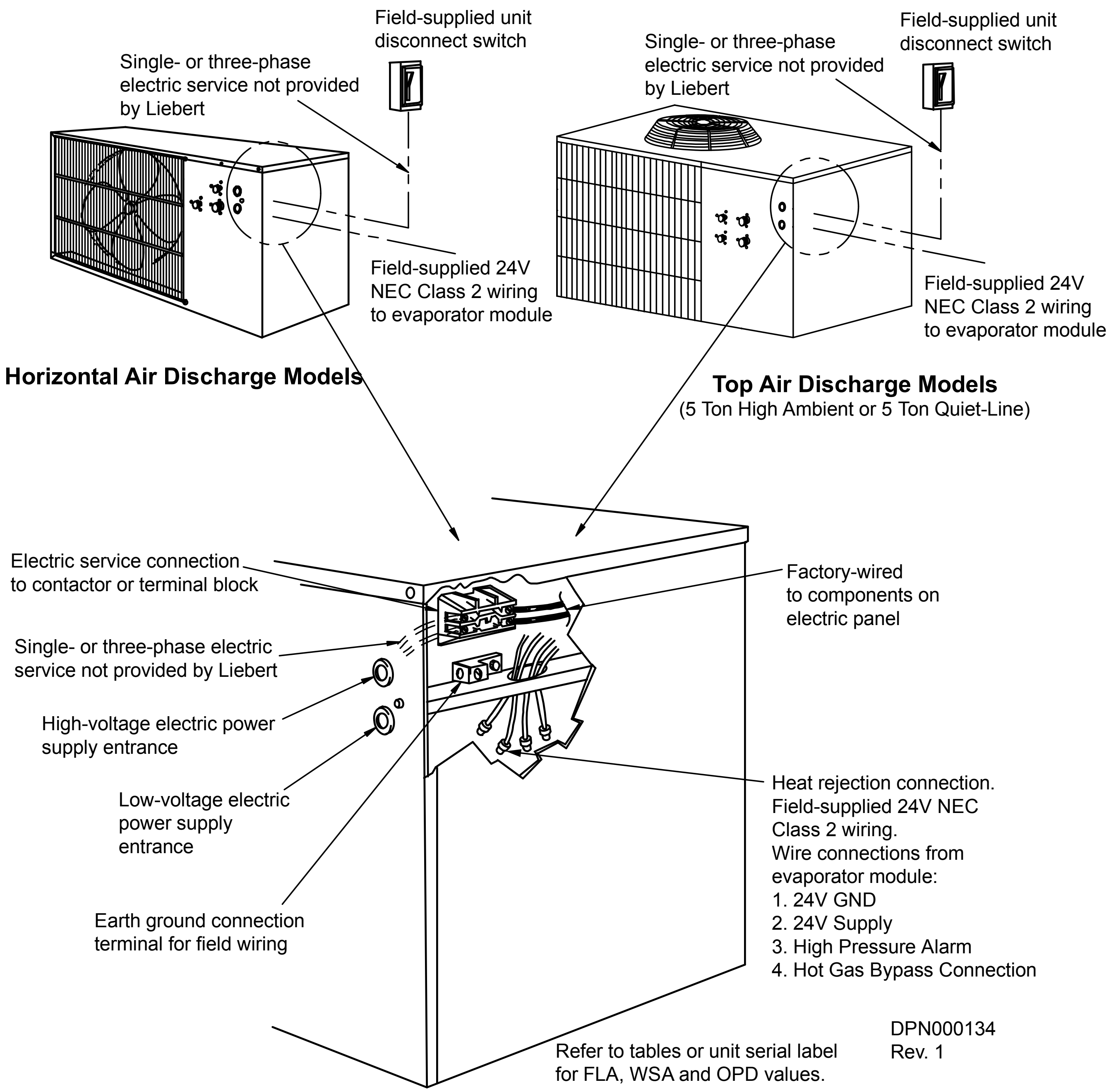


Figure 8 Electrical field connections, 8-ton units

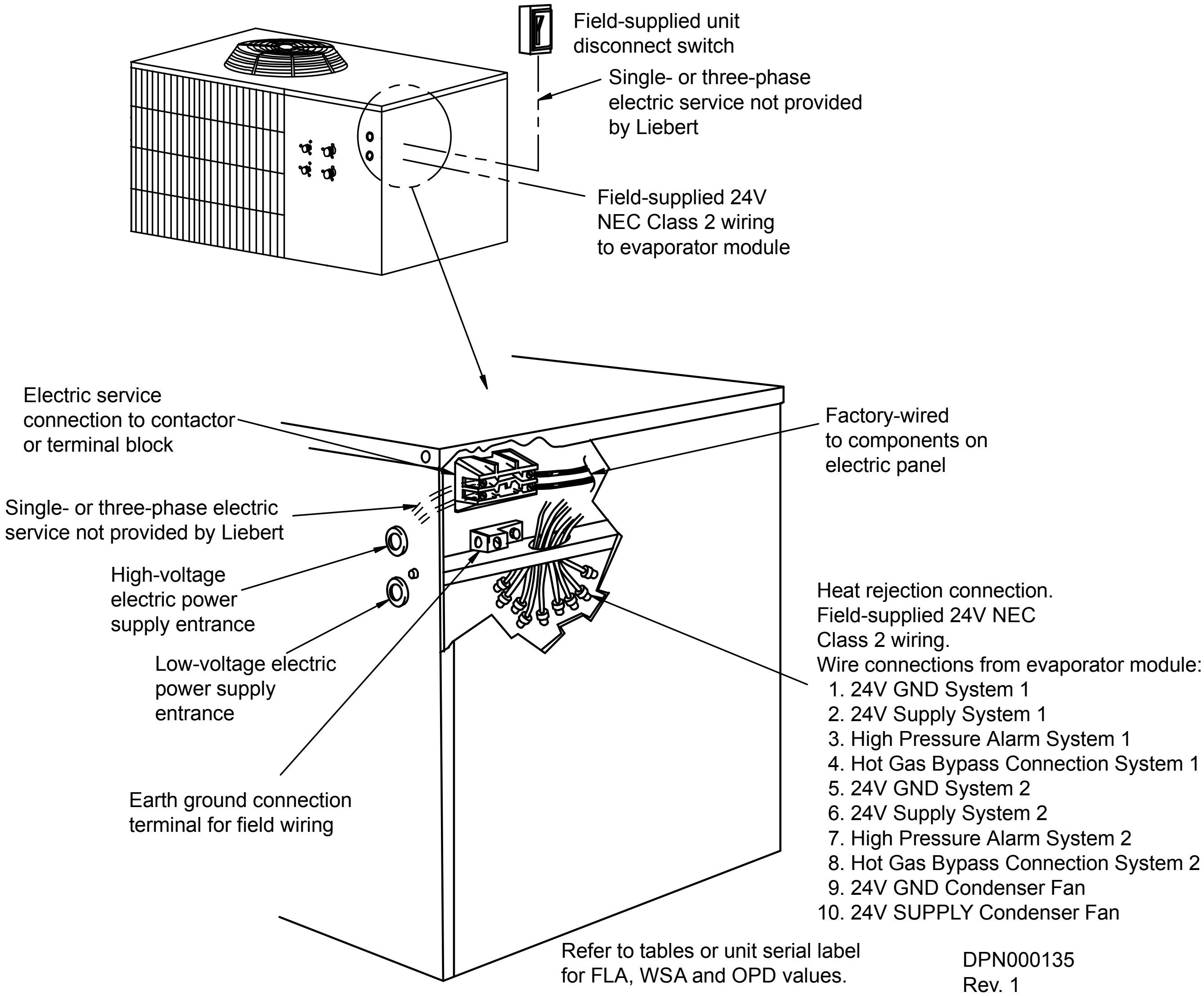
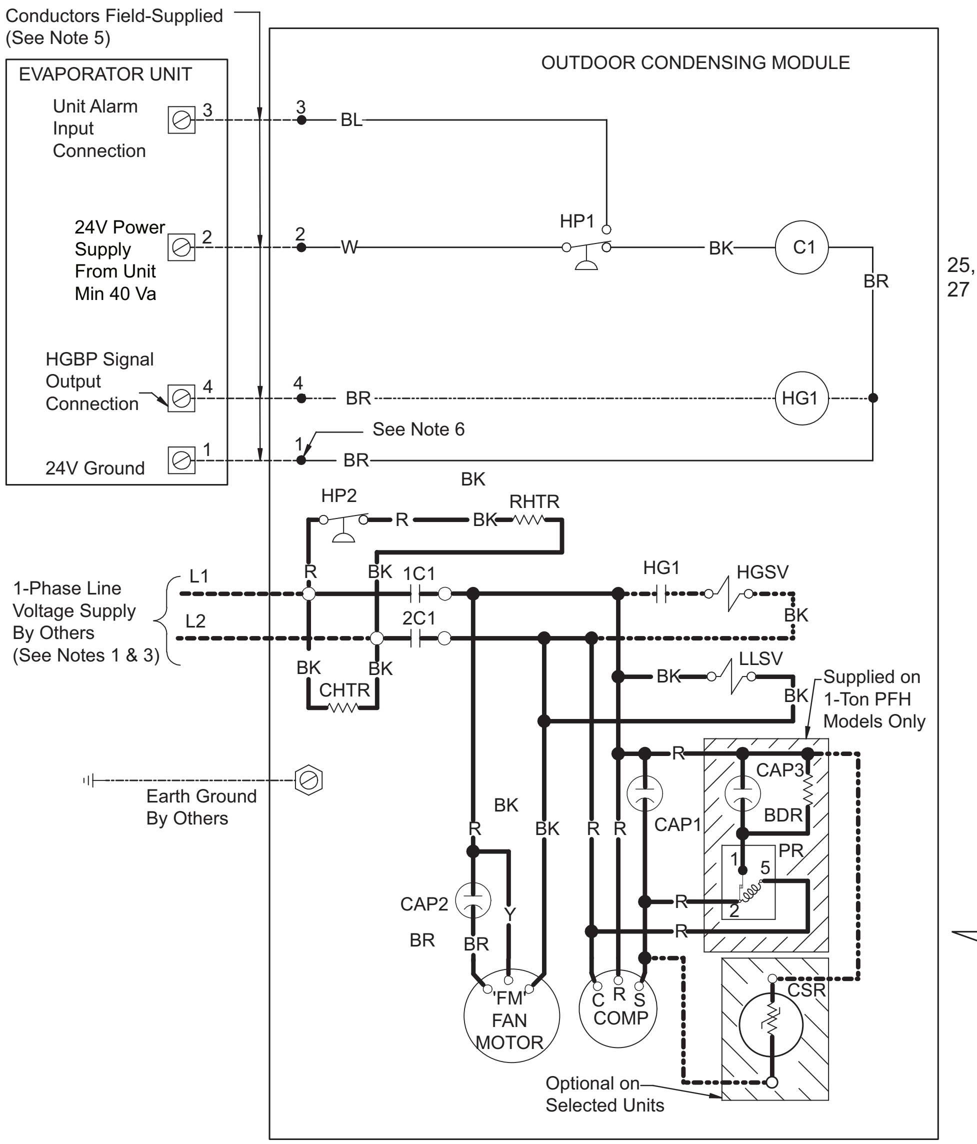


Figure 9 Single-phase, 1-3 ton model schematic, typical



NOMENCLATURE

Standard Devices

BDR -- Bleed Resistor
C1 -- Condenser Contactor
CAP1 -- Compressor Capacitor Run
CAP2 -- Fan Motor Capacitor
CAP3 -- Compressor Capacitor Start
CHTR -- Compressor Heater
COMP -- Compressor
FM -- Fan Motor
HP1 -- High Pressure Switch (Auto Reset)
HP2 -- Pressure Switch Receiver (Auto Reset)
LLSV -- Liquid Line Solenoid Valve
PR -- Potential Relay
RHTR -- Receiver Heater

Optional Devices

CSR -- Compressor Start Resistor
HG1 -- Hot Gas Relay
HGSV -- Hot Gas Solenoid Valve

WIRE COLOR CODE

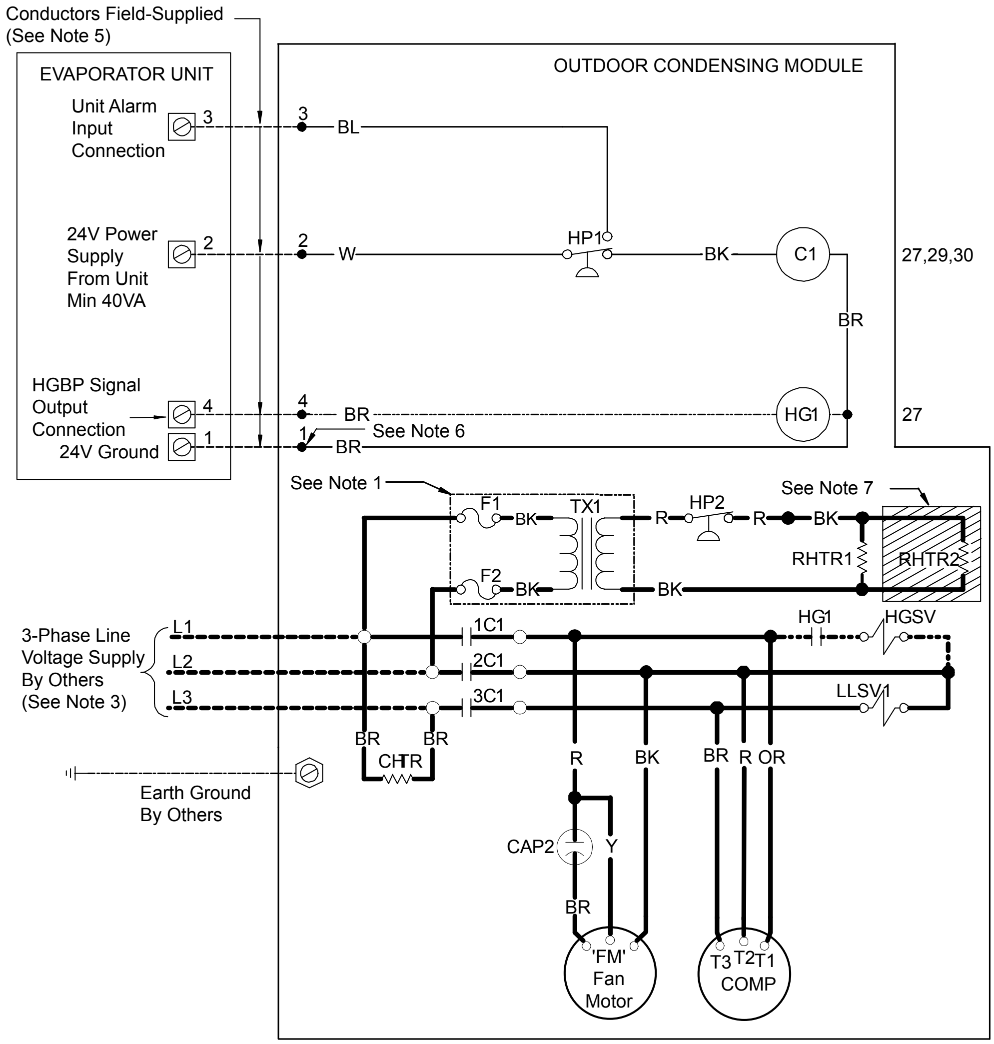
OR - Orange
R - Red
BR - Brown
P - Purple
GN - Green
Y - Yellow
BL - Blue
BK - Black
W - White
Insulation Color
GN / Y
Tracer Color

1. All units 208/230V, 1 phase. On 208/230V units installed in Canada only, CSA requires that L1 and L2 are non-neutral supply conductors. L1 et L2 pour conducteurs d'alimentation non-neutres. On other units, L2 is designated neutral. See unit name plate and installation manual for main supply wiring information. Use copper conductors only.
2. Use copper conductors only. See unit nameplate for main supply wire sizing data. Wire per local codes.
3. A remote disconnect switch is to be field-supplied and mounted within sight of the condensing unit. See unit nameplate for voltage and amperage requirements.
4. All motors have internal line break overload protectors. Three-phase motors protected for primary single-phasing conditions.
5. Terminals 1,2,3, and 4 are for connection of control circuit from evaporator unit. Wiring by others to be NEC Class 2 and sized for 1V maximum drop.
6. Wire '1' is connected to the grounded side of the 24V Class 2 circuit.

Factory-Supplied Line Voltage
Field-Installed Line Voltage Wiring
Optional Line Voltage Wiring
Factory-Supplied 24V NEC Class 2 Wiring
Optional 24V Wiring
Factory-Supplied 24V NEC Class 2 Wiring
Factory-Supplied Earth Grounding Wire
Pigtail Leads 24V Wiring
Terminal Strip Connection
Grounding Lug Connection

191642
Rev. 1

Figure 10 Three-phase, 3-5 ton model schematic, typical



NOMENCLATURE

Standard Devices

C1 -- Condenser Contactor
CAP2 -- Fan Motor Capacitor
CHTR -- Compressor Heater
COMP -- Compressor
F1 -- Transformer Fuse 1
F2 -- Transformer Fuse 2
FM -- Fan Motor
HP1 -- High Pressure Switch (Auto Reset)
HP2 -- Pressure Switch Receiver (Auto Reset)
LLSV -- Liquid Line Solenoid Valve
RHTR1 -- Receiver Heater No. 1
RHTR2 -- Receiver Heater No. 2 (3-,4-,and 5-ton only)
TX1 -- Transformer Line Voltage to230V

Optional Devices

HG1 -- Hot Gas Relay
HGSV -- Hot Gas Solenoid Valve

WIRE COLOR CODE

OR - Orange
R - Red
BR - Brown
P - Purple
GN - Green
Y - Yellow
BL - Blue
BK - Black
W - White

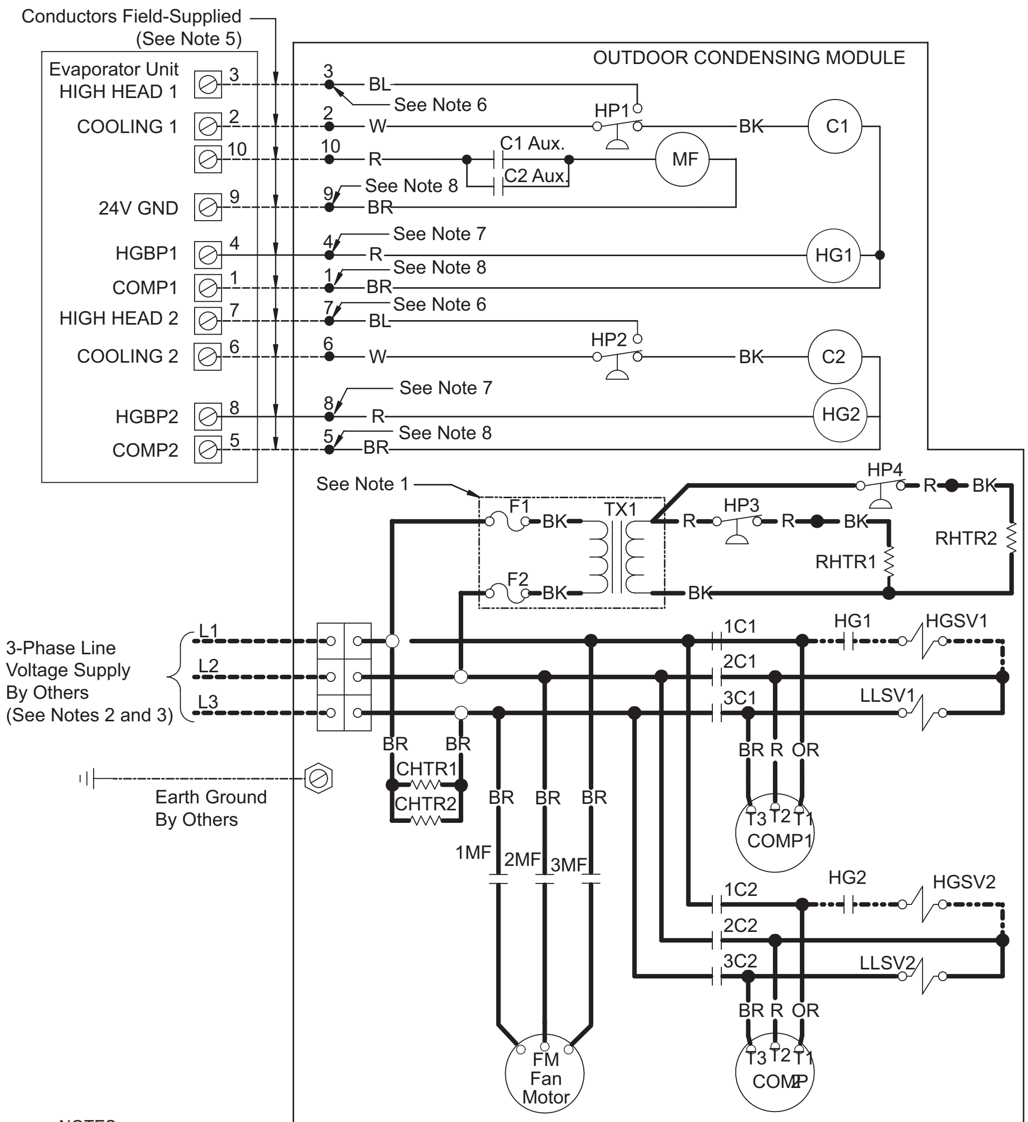
Insulation Color
GN / Y
Tracer Color

1. Transformer 'TX1' provided on units with nameplate voltages greater than 240V.
2. Use copper conductors only. See unit nameplate for main supply wire sizing data. Wire per local codes.
3. A remote disconnect switch is to be field supplied and mounted within sight of the condensing unit. See unit nameplate for voltage and amperage requirements.
4. All motors have internal line break overload protectors. Three-phase motors protected for primary single-phasing conditions.
5. Terminals 1, 2, 3 and 4 are for connection of control circuit from evaporator unit. Wiring by others to be NEC Class 2 and sized for 1 volt maximum drop.
6. Wire '1' is connected to the grounded side of the 24V Class 2 circuit.
7. Receiver heater No.2 'RHTR2' supplied on 4- and 5-ton standard models and 3/3.5-ton high ambient and Quiet-Line models.

Factory-Supplied Line Voltage
Field-Installed Line Voltage Wiring
Optional Line Voltage Wiring
Factory-Supplied 24V NEC Class 2 Wiring
Optional 24V Wiring
Factory-Supplied 24V NEC Class 2 Wiring
Factory-Supplied Earth Grounding Wire
Pigtail Leads 24V Wiring
Terminal Strip Connection
Grounding Lug Connection

191643
Rev. 0

Figure 11 Three-phase, 8 ton model schematic, typical



STANDARD DEVICES
C1 - Compressor Contactor 1
C2 - Compressor Contactor 2
CHTR1 - Compressor Heater 1
CHTR2 - Compressor Heater 2
COMP1 - Compressor #1
COMP2 - Compressor #2
F1 - Transformer Fuse
F2 - Transformer Fuse
FM - Fan Motor
HP1 - High Pressure Switch 1 (Auto Reset)
HP2 - High Pressure Switch 2 (Auto Reset)
HP3 - Pressure Switch 3 Receiver (Auto Reset)
HP4 - Pressure Switch 4 Receiver (Auto Reset)
LLSV1 - Liquid Line Solenoid Valve 1
LLSV2 - Liquid Line Solenoid Valve 2
MF - Fan Motor Contactor
RHTR1 - Receiver Heater No.1
RHTR2 - Receiver Heater No.2
TX1 - Transformer Line Voltage to 230V

OPTIONAL DEVICES
HG1 - Hot Gas Relay 1
HG2 - Hot Gas Relay 2
HGSV1 - Hot Gas Solenoid 1
HGSV2 - Hot Gas Solenoid 2

WIRE COLOR CODE

OR - Orange	Y - Yellow
R - Red	BL - Blue
BR - Brown	BK - Black
P - Purple	W - White
GN - Green	

Insulation Color
GN / Y
Tracer Color

NOTES
1. Transformer TX1 provided on units with nameplate voltages greater than 250V.
2. Use copper conductors only. See unit nameplate for main supply wire sizing data. Wire per local codes.
3. A remote disconnect switch is to be field-supplied and mounted within sight of the condensing unit. See unit nameplate for voltage and amperage.
4. All motors have internal line break overload protectors. Three-phase motors protected for primary single-phasing conditions.
5. Terminals 1 thru 8 are for connection of control circuit from evaporator unit. (Terminals 4 and 8 are not used by some evaporator models . See Note 7). Wiring by others to be NEC Class 2 and sized for 1V maximum drop.
6. Connection to Terminals 3 and 7 is used for high head alarm input connection in evaporator unit.
7. Connection to Terminals 4 and 8 is required only on models with (HGBP) hot gas bypass control signal output in evaporator unit.
8. Wires 1, 5 and 9 are separately connected to the grounded side of the 24V Class 2 circuit. Do not connect them together.

WIRING LEGEND
Factory-supplied line voltage
Field-installed line voltage wiring
Optional line voltage wiring
Factory-supplied 24V NEC Class 2 wiring
Optional 24V wiring
Field-supplied 24V NEC Class 2 wiring
Field-supplied earth grounding wire
Pigtail leads
Terminal strip connection
Grounding lug connection

191647
Rev. 0

2.5 Piping Considerations

The Liebert® Mini-Mate2™, Liebert DataMate™ and the 3-ton Liebert Challenger 3000™ split system units are designed with quick-connect fittings and are factory-charged to proper refrigerant levels. This permits connecting units without brazing inside critical spaces. These split systems require two refrigerant lines—an insulated copper suction line and a copper liquid line—between the evaporator and condensing units. The 8-ton Liebert Mini-Mate2 split system units will require four refrigerant lines between the evaporator and condensing units. Each refrigeration circuit will need one insulated copper suction line and one copper liquid line.

Two methods exist for installing the copper suction and liquid lines:

- Using optional pre-charged line sets (for 1- to 3.5-ton R-407C model units only).
- Using optional Sweat Adapter Kit(s) and hard piping between units.

NOTICE

Risk of improper handling of refrigerant. Can cause environmental damage and violation of environmental regulations.

Refrigerant must handled in accordance with all national, regional and local codes.

NOTE

Proper safety equipment and proper refrigeration tools are required in working with R-407C refrigerant. Check unit serial tag for correct refrigerant type before topping off or recharging a system.

NOTE

Refrigerant R-407C uses a POE (polyol ester) lubricant. The R-407C refrigerant must be introduced and charged from the cylinder only as a liquid.

NOTE

When installing field piping, care must be taken to protect all refrigerant lines from the atmosphere, especially when using refrigerants with POE oils. Do not allow the piping to stand open to air for more than 15 minutes. Units designed for R-407C have a compressor which contains POE oil that is very hygroscopic; that is, it quickly absorbs water from the air. The longer the compressor piping is left open to air, the harder it will be to fully evacuate. If left open too long, the POE oil may need to be replaced before achieving the required vacuum level.

NOTE

Complete all piping and evacuate lines before connecting quick connects when using an optional sweat adapter kit and field installed hard piping.

Follow all proper brazing practices including a dry nitrogen purge to maintain system cleanliness.

2.5.1 Piping for Elevation Differences between PFH and Evaporator

System sizes affect the maximum equivalent piping lengths and maximum relative elevation differences between evaporator and condensing unit mounting locations. See **Table 5** for requirements.

Traps in refrigerant piping are required when elevation differences exist between evaporator and condensing unit mounting locations. See **Figure 12** for requirements. **Table 6** should be used when traps are required with field-fabricated piping assemblies, to calculate equivalent pipe lengths to determine if installation will comply with **Table 5** requirements.

Figure 12 Refrigerant piping diagram

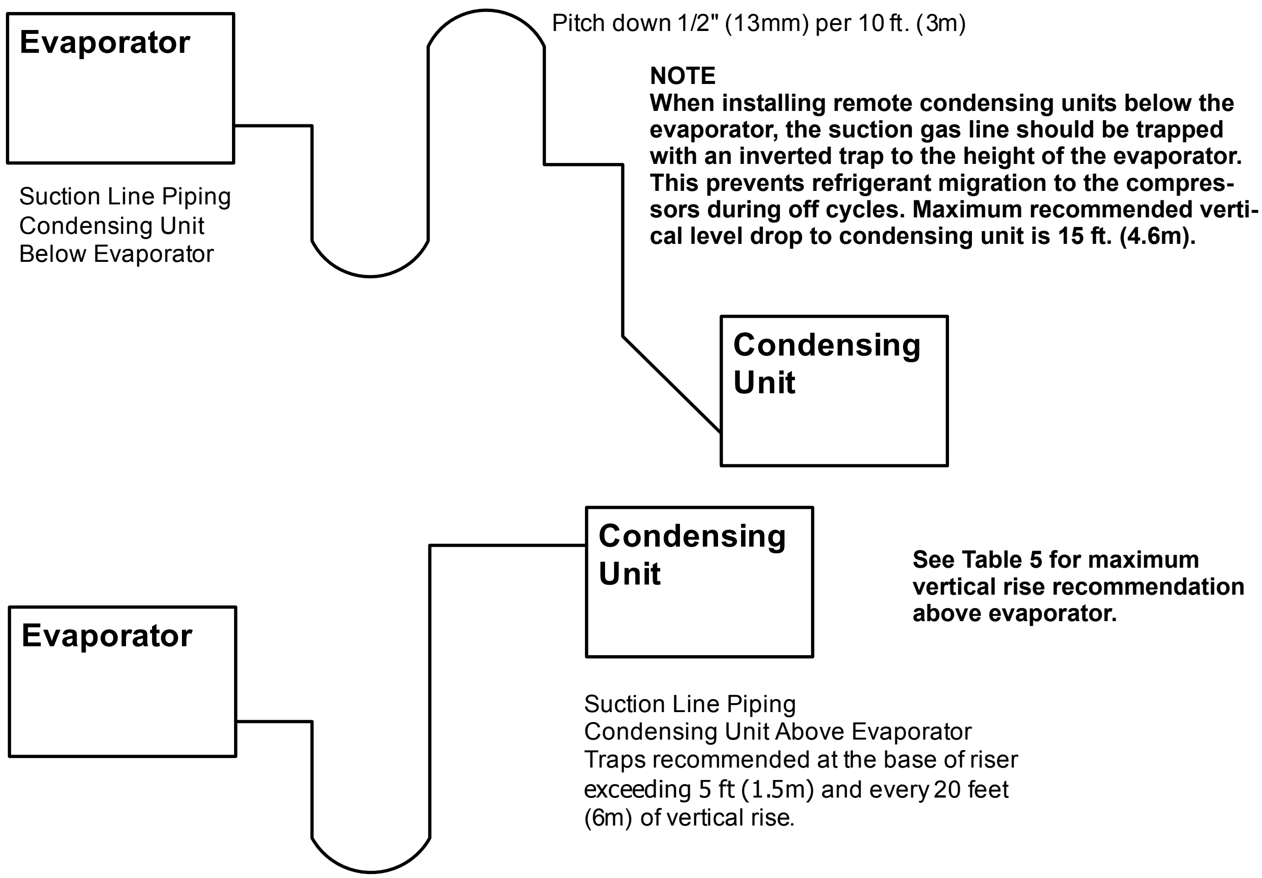


Table 5 Pipe length and condenser elevation relative to evaporator

Nominal System Size Tons	Max. Equiv. Pipe Length ft. (m)	Maximum PFH Level Above Evaporator, ft. (m)	Maximum PFH Level Below Evaporator, ft. (m)
1, 1.5, 2	150 (45)	40 (12)	15 (4.6)
3, 3.5, 5, 8	150 (45)	50 (15)	15 (4.6)

Table 6 Equivalent lengths for various pipe fittings, ft (m)

Copper Pipe OD, in.	90 Degree Elbow Copper	90 Degree Elbow Cast	45 Degree Elbow	Tee	Gate Valve	Globe Valve	Angle Valve
1/2	0.8 (0.24)	1.3 (0.39)	0.4 (0.12)	2.5 (0.76)	0.26 (0.07)	7.0 (2.13)	4.0 (1.21)
5/8	0.9 (0.27)	1.4 (0.42)	0.5 (0.15)	2.5 (0.76)	0.28 (0.08)	9.5 (2.89)	5.0 (1.52)
3/4	1.0 (0.3)	1.5 (0.45)	0.6 (0.18)	2.5 (0.76)	0.3 (0.09)	12.0 (3.65)	6.5 (1.98)
7/8	1.45 (0.44)	1.8 (0.54)	0.8 (0.24)	3.6 (1.09)	0.36 (0.1)	17.2 (5.24)	9.5 (2.89)
1-1/8	1.85 (0.56)	2.2 (0.67)	1.0 (0.3)	4.6 (1.4)	0.48 (0.14)	22.5 (6.85)	12.0 (3.65)
1-3/8	2.4 (0.73)	2.9 (0.88)	1.3 (0.39)	6.4 (1.95)	0.65 (0.19)	32.0 (9.75)	16.0 (4.87)
1-5/8	2.9 (0.88)	3.5 (1.06)	1.6 (0.48)	7.2 (2.19)	0.72 (0.21)	36.0 (10.97)	19.5 (5.94)

Refrigerant trap = Four times equivalent length of pipe per this table

2.5.2 Pre-Charged Line Sets

Liebert® pre-charged line sets are available in 15 ft. (4.5m) and 30 ft. (9m) lengths (see **Table 7**).

NOTICE

Risk of improper handling and installation of pre-charged lines. Can cause kinks and similar damage to lines.

Care must be taken to prevent kinking the pre-charged lines for 1-ton and 3.5-ton units.

Use tube benders and make all bends before making connections to either end of the pre-charged pipes. Coil any excess tubing in a horizontal plane with the slope of the tubing toward the condensing unit. Use a soft, flexible material to pack around the tubes when sealing openings in walls to prevent tube damage and to reduce vibration transmission.

Table 7 Refrigerant charge in Liebert pre-charged R-407C line sets

Line Size, in.	Length, ft. (m)	Charge R-407C, lb-oz (kg)
3/8 liquid	15 (4.5)	0-5 (0.14)
	30 (9)	0-10 (0.28)
5/8 or 7/8 suction	15 (4.5)	0-5 (0.14)
	30 (9)	0-10 (0.28)

2.5.3 Field-Fabricated Line Sets

All field-fabricated refrigeration piping should be copper piping, brazed using a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. Avoid soft solders such as 50/50 or 95/5.

Use the sweat adapter kits to terminate the piping at each unit end. Consult factory representatives to obtain the proper sweat adapter kit. **Table 8** has PFH unit connection sizes. Use **Table 9** for recommended line sizes.

Prevailing good refrigeration practices should be employed for piping supports, leak testing, evacuation, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration-isolating supports. Use a soft, flexible material to pack around the tubes when sealing openings in walls to prevent tube damage and to reduce vibration transmission.

Before connecting units together with field-fabricated piping, check for leaks and dehydrate the field piping as follows:

1. Pressurize the field piping to 150 psig (1034 kPa) using dry nitrogen with a trace of refrigerant. Check system for leaks with a suitable leak detector.
2. After completion of leak testing, release the test pressure (per local code) and triple evacuate the field piping to 250 microns or lower, breaking the vacuum between the first two evacuations with dry nitrogen.
3. After the third evacuation, verify 250 microns is maintained for at least one minute after the piping is isolated from the vacuum pump by a shutoff valve.

Field piping is now ready to be installed between evaporator and condensing units.

Table 8 Liebert® PFH unit charge levels and coupling size

Model Numbers		R-407C Charge	Coupling Size	
60 Hz	50 Hz	lb-oz (kg)	Liquid	Suction
95°F (35°C) Standard Sound				
PFH014A-_L7	—	8-6 (3.80)	#6	#11
PFH020A-_L7	—			
PFH027A-_L7	—			
PFH037A-_L7	PFH036A-_L7	13-5 (6.04)	#6	#11
PFH042A-_L7	PFH041A-_L7			
PFH067A-_L7	PFH066A-_L7	26-10 (12.08)	#10	#12
PFH096A-_L7	PFH095A-_L7			
3-ton Circuit	3-ton Circuit	22-9 (10.23)	#6	#11
5-Ton Circuit	5-Ton Circuit	36-5 (16.47)	#10	#12
105°F (41°C) High Ambient				
PFH027A-_H7	—	13-5 (6.04)	#6	#11
PFH037A-_H7	PFH036A-_H7	26-10 (12.08)	#6	#11
PFH042A-_H7	PFH041A-_H7			
PFH067A-_H7	PFH066A-_H7	51-11 (23.45)	#10	#12
Quiet-Line				
PFHZ27A-_L7	—	13-5 (6.04)	#6	#11
PFHZ37A-_L7	PFHZ36A-_L7	26-10 (12.08)	#6	#11
PFHZ42A-_L7	PFHZ41A-_L7			
PFHZ67A-_L7	PFHZ66A-_L7	51-11 (23.45)	#10	#12

Table 9 Recommended line sizes, OD Cu

Equiv. ft. (m)	PFH_14A		PFH_20A		PFH_27A		PFH_36A PFH_37A 3-ton circuit of 8-ton model		PFH_42A PFH_41A		PFH_67A PFH_66A 5-ton circuit of 8-ton model	
	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid
50 (15.2)	5/8"	3/8"	5/8"	3/8"	7/8"	3/8"	7/8"	1/2"	7/8"	1/2"	1-1/8"	1/2"
75 (22.9)	5/8"	3/8"	7/8"	3/8"	7/8"	3/8"	7/8"	1/2"	7/8"	1/2"	1-1/8"	5/8"
100 (30.5)	7/8"	3/8"	7/8"	3/8"	7/8"	1/2"	1-1/8" [2]	1/2"	1-1/8"	1/2"	1-1/8"	5/8"
125 (38.1)	7/8"	3/8"	7/8"	1/2"	7/8"	1/2"	1-1/8" [2]	1/2"	1-1/8"	1/2"	1-3/8"	5/8"
150 (45.7)	7/8"	3/8"	7/8"	1/2"	7/8"	1/2"	1-1/8" [2]	1/2"	1-1/8"	5/8"	1-3/8"	5/8"

1. Suction and liquid line sizing based on < 3 psi pressure drop in each, minimum horizontal suction line velocity > 700FPM (3.6m/s).
2. Suction size should be reduced one pipe size for vertical riser sections to maintain suction line velocity > 1000FPM (5.1m/s) for proper oil return.

2.5.4 Installation of Piping to Units

NOTE
When using hard piping, complete all piping and evacuate the lines before connecting quick-connects.

NOTE
Liebert® Challenger™ 5-ton evaporator includes a nitrogen holding charge only. This holding charge must be evacuated and unit placed in a 250 micron vacuum prior to connecting piping. See ***Table 12*** *for field charge required.*

Use caution when connecting the quick-connect fittings. Read through the following steps before making the connections.

1. Remove protector caps and plugs.
2. Carefully wipe coupling seats and threaded surfaces with a clean cloth.
3. Lubricate the male diaphragm and synthetic rubber seal with refrigeration grade oil.
4. Thread the coupling halves together by hand to ensure that the threads mate properly.
5. Tighten the coupling body hex nut and union nut with the proper sized wrench until the coupling bodies bottom out or until you feel a definite resistance.
6. Using a marker or pen, make a line lengthwise from the coupling union nut to the bulkhead.
7. Tighten the nuts an additional quarter turn; the misalignment of the lines shows how much the coupling has been tightened. This final quarter turn is necessary to ensure that the joint will not leak. Refer to **Table 10** for torque requirements.
8. Add liquid refrigerant charge for any field-fabricated piping (refer to **Table 11**) and the 5-ton Liebert Challenger evaporator if used (refer to **Table 12**).

Table 10 Piping connection sizes and torque

Line Size, OD Cu	Coupling Size	Torque, lb-ft. (N-m)
1/4 or 3/8	#6	10-12 (145-175)
5/8 thru 7/8	#10 or #11	35-45 (510-655)
1-1/8	#12	50-65 (730-950)

Table 11 Line charges - refrigerant per 100 ft. (30m) of Type L copper tube

Line Size, O.D., in.	R-407C, lb/100 ft. (kg/30m)	
	Liquid Line	Suction Line
3/8	3.7 (1.7)	—
1/2	6.9 (3.1)	—
5/8	11.0 (5.0	0.4 (0.2)
3/4	15.7 (7.1)	0.6 (0.3)
7/8	23.0 (10.4)	1.0 (0.4)
1-1/8	—	1.7 (0.7)
1-3/8	—	2.7 (1.1)

2.5.5 R-407C PFH Installed as a Replacement Condensing Unit in an R-22 System

When replacing the condensing unit of an existing Liebert split system containing R-22 and mineral oil, the following should be considered.

1. Check for proper operation of the system prior to replacing the outdoor unit. If this is not possible, at minimum perform a leak check to ensure that the components that remain (line set, evaporator) are leak tight.
2. Check for acid or contaminants in the mineral oil.

Remove Existing Condensing Unit

1. Recover refrigerant in system using proper refrigeration practices.
2. Oil removal: The majority of the oil will be in the old condensing unit (compressor, condenser and receiver), which will be replaced with the new unit.
3. Remove high-voltage and low-voltage wiring.

NOTE

Wiring should be removed by a licensed electrician.

Existing low-voltage wiring may have a 3-wire lead. A 4-wire lead is required for hot gas bypass control on the new condensing unit.

4. Cut the line set before the Aeroquip fittings entering the condensing unit.
5. Remove the existing filter drier in evaporator unit and discard. The filter drier may contain contaminants that can be released out of the drier because of the POE oil.

Filter Drier Selection and Installation

Recommended

1. Install a replaceable-core filter drier approved for POE oil. The existing drier must be removed. The replaceable core drier will not fit in the same location as the existing drier.
2. Ensure there is enough clearance for replacing cores when choosing a location.
3. Replace core a week after startup and inspect the removed replaceable core for contaminants to determine if another replacement is needed. (If the system experienced a burnout, shorter interval replacements will be needed.)

Optional

Install a new filter drier approved for POE oil in place of the existing one.

Install the New Condensing Unit

1. Install a stub tube kit on the existing line set connecting to the new condensing unit. This kit is available from Emerson or your local Emerson representative.
2. Evacuate the evaporator-piping system twice to a minimum 250 microns, breaking the vacuum with dry nitrogen each time.
3. Evacuate a third time to 250 microns and verify the above levels are maintained for at least one minute after the unit is isolated from the vacuum pump by a shutoff valve.
4. Connect the condensing unit with the evaporator and piping (see **2.5.4 - Installation of Piping to Units**).
5. Add enough R-407C refrigerant for the evaporator unit and line set. See **Table 11** for line set charges required and **Table 12** for standard evaporator units. If a non-standard evaporator was used, refer to evaporator unit serial tag for charge amounts and use 1 oz. (0.0283kg) R-407C for every 1 oz. (0.0283kg) R-22 used in old evaporator and piping.

2.5.6 General System Charge Requirements

Liebert® split system units are designed with quick-connect fittings and are factory-charged to proper levels. Due to the wide range of operating ambients and sensitivity of the system components to charge level, the system charge must be maintained at recommended levels.

If there is any doubt that the system has the correct refrigerant charge level, the correct procedure is to remove the entire system charge, evacuate the system and weigh in the recommended factory charge total for both units and any line sets or field piping.

Tables 7, **8**, **11** and **12** are included for field piping allowances, condensing unit charges, line sets and evaporator charges.

Total refrigerant charge = evaporator + lines + condensing unit

NOTE

All condensing units and most evaporator units are fully charged with refrigerant. Some evaporator units are shipped from the factory with a nitrogen holding charge only. (Refer to evaporator serial tags.) If field-supplied refrigerant piping is installed, refrigerant must be added to the system. Refer to ***Figure 12*** *for field-supplied piping guidelines.*

Table 12 Evaporator Charge Levels

Indoor Unit	Evaporator Models	Charge R-407C oz (kg)
Liebert Mini-Mate2™	MMD12E	3 (0.085)
	MMD18E	4 (0.113)
	MMD24E	7 (0.198)
	MMD35/36E	7 (0.198)
	MMD59/60E	4 (0.113)
	MMD95/96E	7 (0.198) each circuit
Liebert DataMate™	DME020E	4 (0.113)
	DME027E	5 (0.141)
	DME037E	6.5 (0.184)
Liebert Challenger™ 3000	BF/BU036E	9 (0.255)
	BF/BU060E*	13 (0.368)

* Evaporator is charged with nitrogen at the factory

2.6 Electrical Connections

Each unit is shipped from the factory with all internal wiring completed. All power, control wiring and ground connections must be made in accordance with the National Electrical Code and local codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to **Figures 5**, **7** and **8** and electrical schematic (reference **Figures 9** through **11**) when making connections. A manual electrical disconnect switch should be installed within 5 feet (1.6m) of the unit in accordance with codes.

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. Use a voltmeter to be sure power is turned off before making any electrical connections.

NOTICE

Risk of incorrect phase sequencing. Can cause equipment damage.

Three-phase power must be connected to the unit line voltage terminals in proper sequence so that the scroll compressor rotates in the correct direction.

The three-phase scroll compressor requires proper phasing to ensure correct motor rotation. The component connections have been phase synchronized at the factory. Power phasing should be changed only at the line voltage supply to the unit. To change phasing, switch any two power leads to the unit. Observe system pressures to determine whether the unit is operating properly.

NOTICE

Risk of compressor slugging. Can cause equipment damage.

Apply power to condenser 8 hours before operating the system. This time is required to allow liquid refrigerant to be driven out of the compressor. This is especially important at low ambient temperatures. The compressor crankcase heater is energized as long as power is supplied to the unit.

Table 13 Design refrigerant pressures

Suction	53 - 95 PSIG (365 to 655 kPa)
Discharge (At Design Ambient)	280 psig (1930 kPa)
High-Pressure Cutout	400 psig (2760 kPa)

Table 14 Application limits

<table>
<tr><th colspan="2">Input voltage</th><th colspan="2">Dry Bulb Air Temperature at Condenser</th></tr>
<tr><th>Minimum</th><th>Maximum</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td>-10%</td><td rowspan="2">+10%</td><td rowspan="2">-30°F (-34°C)</td><td>115°F (46°C) Std
Ambient & Quiet-Line</td></tr>
<tr><td>-5% 208/230V
single-phase</td><td>125°F (52°C)
High Ambient Models</td></tr>
</table>

2.6.1 Low-Voltage Control Wire Connections

Field-supplied four-wire control connection (10-wire on 8-ton units) is required between the outdoor condensing unit and the evaporator. Refer to **Figures 5**, **7** and **8** and to unit electrical schematic and **Figures 9** through **11**.

2.6.2 Low-Voltage Control Wire Sizing

Low-voltage wiring should be sized to allow a 1 volt maximum drop due to line resistance between the evaporator and condensing unit. Use NEC Class 1 or 2 wiring according to wire routing conditions chosen, local codes and application limits in **Tables 14** and **15**.

Table 15 Recommended minimum wire size

Max. Distance* ft. (m)	Min. Wire Gauge AWG (mm^2)
50 (15)	20 (0.75)
100 (30)	18 (1.0)
150 (45)	16 (1.5)

* One-way control wire run between outdoor condensing unit and evaporator.

2.7 Electrical Data

Table 16 Electrical data—Standard sound and ambient models (95°F/35°C) 60Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage- Phase			
			208/230-1	208/230-3	460-3	575-3
14	1	FLA	9.1	—	—	—
		WSA	11.0	—	—	—
		OPD	15	—	—	—
20	1.5	FLA	12.1	—	—	—
		WSA	14.8	—	—	—
		OPD	25	—	—	—
27	2	FLA	13.4	—	—	—
		WSA	16.4	—	—	—
		OPD	25	—	—	—
37	3	FLA	18.5	13.4	7.1	5.8
		WSA	22.8	16.4	8.7	7.0
		OPD	35	25	15	15
42	3.5	FLA	—	15.0	7.1	6.0
		WSA	—	18.4	8.7	7.2
		OPD	—	30	15	15
67	5	FLA	—	24.1	11.7	9.1
		WSA	—	29.3	14.2	11.1
		OPD	—	45	20	15
96	8	FLA	—	36.2	18.1	13.4
		WSA	—	41.4	20.6	15.3
		OPD	—	60	30	20

* **FLA** = Full Load Amps
WSA = Wire Size Amps (minimum supply circuit current capacity)
OPD = Overcurrent Protection Device (fuse or circuit breaker)

Table 17 Electrical data—High ambient models (105°F/41°C) 60Hz

Model #	Nominal Capacity, Tons	* Electrical Characteristic	Input Voltage-Phase			
			208/230-1	208/230-3	460-3	575-3
27	2	FLA	15.4	—	—	—
		WSA	18.4	—	—	—
		OPD	30	—	—	—
37	3	FLA	20.5	15.4	8.1	5.8
		WSA	24.8	18.4	9.7	7.0
		OPD	40	30	15	15
42	3.5	FLA	—	17.0	8.1	6.0
		WSA	—	20.4	9.7	7.2
		OPD	—	30	15	15
67	5	FLA	—	24.2	11.7	9.3
		WSA	—	29.4	14.2	11.3
		OPD	—	50	20	15

* **FLA** = Full Load Amps
WSA = Wire Size Amps (minimum supply circuit current capacity)
OPD = Overcurrent Protection Device (fuse or circuit breaker)
Model # 14, 20 and **96** are not available in high ambient versions.

Table 18 Electrical data—Quiet-Line models (95°F/35°C) 60Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage-Phase			
			208/230-1	208/230-3	460-3	575-3
27	2	FLA	12.9	—	—	—
		WSA	15.9	—	—	—
		OPD	25	—	—	—
37	3	FLA	18.0	12.9	7.1	—
		WSA	22.3	15.9	8.7	—
		OPD	35	25	15	—
42	3.5	FLA	—	14.5	6.9	—
		WSA	—	17.9	8.5	—
		OPD	—	30	15	—
67	5	FLA	—	22.5	10.9	8.3
		WSA	—	27.7	13.4	10.2
		OPD	—	45	20	15

* **FLA** = Full Load Amps
WSA = Wire Size Amps (minimum supply circuit current capacity)
OPD = Overcurrent Protection Device (fuse or circuit breaker)
Model # 14, 20 and **96** are not available in Quiet-Line versions.

Table 19 Electrical data—Standard sound and ambient models (95°F/35°C) 50Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage-Phase	
			220-1	380/415-3
36	3	FLA	18.4	7.0
41	3.5	FLA	—	8.5
66	5	FLA	—	11.7
95	8	FLA	—	18.1

* **FLA** = Full Load Amps

Table 20 Electrical data—High ambient models (105°F/41°C) 50Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage-Phase	
			220-1	380/415-3
36	3	FLA	20.5	8.1
41	3.5	FLA	—	9.6
66	5	FLA	—	11.7
95	8	FLA	—	—

* **FLA** = Full Load Amps

Table 21 Electrical data—Quiet-Line models (95°F/35°C) 50Hz

Model #	Nominal Capacity Tons	* Electrical Characteristic	Input Voltage-Phase	
			220-1	380/415-3
36	3	FLA	18.0	6.9
41	3.5	FLA	—	8.4
66	5	FLA	—	10.9
95	8	FLA	—	—

* **FLA** = Full Load Amps

2.8 Checklist for Completed Installation

___ 1. All items unpacked and checked.

___ 2. Proper clearances for service access maintained around equipment.

___ 3. Equipment is level and mounting fasteners are tight.

___ 4. Piping completed to refrigerant loop.

___ 5. All piping connections are tight.

___ 6. Piping routed to prevent chafing and rub-through.

___ 7. Piping has been evacuated and refrigerant charge added (if required).

___ 8. Line voltage to power wiring matches equipment nameplate.

___ 9. Power wiring connections completed, including earth ground.

___ 10. Power line circuit breakers or fuses have proper ratings for equipment installed.

___ 11. Control wiring connections completed.

___ 12. All wiring connections are tight.

___ 13. Foreign materials have been removed from area: in and around all equipment installed (shipping materials, construction materials, tools, etc.).

___ 14. Fans and blowers rotate freely and in the proper direction.

___ 15. Blank startup sheet has been sent with the evaporator unit and is ready to be completed by the installer.

3.0 OPERATION

3.1 Compressor

The scroll compressor is equipped with a band type crankcase heater to resist liquid refrigerant migration into the compressor during the Off cycle. The three-phase scroll compressor requires proper phasing to ensure correct motor rotation. The component connections have been phase synchronized at the factory. Refer to **2.6 - Electrical Connections** to verify proper compressor wiring.

3.2 High Head Pressure

Compressor high head pressure is monitored with a pressure switch. One SPDT pressure switch is used for each compressor in the unit. If head pressure exceeds 400 psig (2760 kPa), the switch opens the compressor contactor and sends an input signal to the evaporator wall-box control. The high head pressure condition is acknowledged by pressing the alarm silence button, which will clear the alarm if the high head pressure condition no longer exists.

If the compressor is off for 1 hour, the control goes into a special cold-start mode. In the cold-start mode on a call for cooling or dehumidification, the liquid line solenoid valve (LLSV) is energized. If the high-pressure switch does NOT trip within 10 seconds, the control returns to normal operation of monitoring the high head pressure switch for three occurrences in a 12-hour period. It is a rolling timer and after the third high head alarm occurs and is acknowledged by the user, it will lock off the compressor. If while in the cold-start mode the high head pressure switch DOES trip within 10 seconds of the activation of the LLSV, the control does not annunciate the alarm. The control will turn off the LLSV and delay 10 seconds. The control will permit this occurrence two more times, or a total of three times. If on the fourth try the high head pressure switch trips within 10 seconds, the control will annunciate the alarm, turn off the LLSV, wait for the user to acknowledge the alarm and hold the compressor off for 3 minutes, which is the normal short cycle control. The control will permit this occurrence three times. On the third occurrence, the control will lock the compressor off until the control power is reset.

Check for these conditions:

- Power shut off to the condensing unit
- Condensing unit fan not working
- Defective head pressure control valves
- Closed services valves
- Dirty condensing coils
- Crimped lines

3.3 Liebert® Lee-Temp™ Flood Back Head Pressure Control

Outdoor condensing unit components for head pressure control include a receiver, heater and three-way head pressure control valve. The head pressure control valve operates to maintain a minimum condensing pressure. During low ambient temperature operation, the valve meters discharge gas into the receiver to maintain a discharge pressure operating against the valve dome. This closes the condenser port, backing liquid refrigerant into the condenser coil, reducing its area available for condensing. A receiver sized to hold the additional charge required to flood the condenser is provided.

A temperature-compensated heater maintains the liquid refrigerant pressure during Off cycles. A liquid pressure switch is also installed to turn the heater Off during operation, when the receiver pressure is high. The heater pressure switch has a cutout of 150psig (1034kPa) and a cut-in of 100psig (690kPa). The receiver includes a pressure relief valve set for 475psig (3275kPa).

3.4 Hot Gas Bypass

3.4.1 Operation

When applying hot gas bypass with split system condensing units, bypassing discharge gas to the compressor suction line offers more flexibility than conventional hot gas bypass to the evaporator unit.

The hot gas bypass valve is installed between the compressor discharge piping and suction piping, bypassing the condenser and evaporator coils. The discharge gas mixes with the suction gas, raising the suction temperature and pressure and decreasing the mass flow through the evaporator. The higher suction temperatures could cause compressor overheating, therefore a separate liquid quenching valve is provided to mix refrigerant from the system liquid line with the discharge gas before mixing with the suction gas entering the compressor. (Refer to **Figure 6**).

During normal operation, when the evaporator is under full load the hot gas bypass equalizer pressure will remain high enough to keep the valve port closed. If the evaporator load decreases the evaporator temperature and pressure will drop. When the suction pressure reduces below the hot gas bypass valve setting, the hot gas bypass valve opens, diverting some of the refrigerant flow back to the compressor suction. The liquid quenching valve bulb senses this increased superheat and opens, allowing liquid refrigerant to mix with the discharge gas, desuperheating it.

Proper mixing of the three refrigerant paths ensures stable operation and system performance. The liquid quenching valve bulb must be located downstream of all these connections to control superheat at the compressor inlet. Superheat settings for the liquid quenching valve are chosen to maintain consistency with the system expansion valve. During hot gas bypass operation higher superheats, 50-60°F (10-15°C), may be observed at the compressor. The liquid-quenching valve is internally equalized and superheat is not adjustable.

To aid in lubricating the compressor, the hot gas bypass solenoid is delayed for 30 seconds on the initial call for cooling and de-energized for 30 seconds during every 60 minutes of continuous operation.

3.4.2 Adjustment

Upon deciding what evaporator temperature is desired, the following procedure should be used to adjust the hot gas bypass valve:

1. Install the suction and discharge pressure gauge.
2. Adjust temperature setpoint to call for cooling so that the refrigeration compressor will run continuously.
3. Remove the **top** adjusting nut from the valve.
4. Insert an Allen wrench in the brass hole at top of valve in adjusting port and turn clockwise if a higher evaporator temperature is required. Adjust no more than 1/4 turn at a time. Let the system stabilize for 15 minutes before determining if additional adjustments are necessary.
5. After obtaining the suction pressure required, reinstall cap tightly making sure there are no leaks.
6. Let the system operate for approximately 10 to 15 minutes to make sure the suction pressure is within the range desired.
7. There may be a variation of approximately 3 to 6psig (21 to 41kPa) on the evaporator due to the differential on the hot gas bypass.
8. Return temperature setpoint to the desired setting.

4.0 MAINTENANCE

4.1 General

Access the condensing unit by removing the unit housing panel. Clean the air cooled condenser coil of all debris that will inhibit airflow. This can be done with compressed air or with a commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. During winter, do not permit snow to accumulate on or around the condensing unit. Check all refrigerant lines and capillaries for vibration isolation and support as necessary. Check all refrigerant lines for signs of leaks.

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. Turn Off power to unit at disconnect switch unless you are performing tests that require power. With power and controls energized, unit could begin operating automatically at any time.

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. Hazardous voltage will still be present at condenser even with power turned Off at the control panel. To isolate unit for maintenance, turn the unit Off at disconnect switch.

NOTICE

Risk of compressor slugging. Can cause equipment damage.

If condenser power is disconnected for a long period, do not attempt to start the condensing unit until 8 hours after restoring power. This allows time for liquid refrigerant to be driven out of the compressor. This is especially important at low ambient temperatures.

4.2 Compressor Failure

If a compressor motor burns out, the stator wiring insulation decomposes, forming carbon, water and acid. Not only must the compressor be replaced, but the entire refrigeration circuit must be cleaned of the harmful contaminants left by the burnout. Successive burnouts of the same system can usually be attributed to improper system cleaning.

NOTICE

Risk of improper cleaning. Can cause equipment damage.

Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty.

Before proceeding with a suspected burnout, check all electrical components: fuses, contactors and wiring. Check high-pressure switch operation. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure. An electrical failure will be indicated by a distinct, pungent odor. If a severe burnout has occurred, the oil will be black and acidic. In the case of a mechanical failure, there will be no burn odor and the motor will attempt to run.

4.2.1 Electrical Failure—Burnout

In the event that there is an electrical failure and a complete burnout of the refrigeration compressor motor, the proper procedures must be performed in order to clean the system to remove any acids that would cause a future failure.

NOTE
Failure to properly clean the system after a compressor motor burnout will void the compressor warranty. Follow the manufacturer's procedure.

NOTICE

Risk of contact with caustic substances. Can cause personal injury.

Avoid touching or contacting the gas and oils with exposed skin. Severe burns may result. Use long rubber gloves in handling contaminated parts.

4.2.2 Mechanical Failure

If a mechanical failure has occurred, the compressor must be replaced.

4.3 Compressor Replacement

Replacement compressors are available from Emerson. They will be shipped in a permanent crate to the job site as required by the service contractor.

Upon shipping a replacement compressor, the service contractor will be billed in full for the compressor. Credit for warranty replacement compressors will not be issued until the replacement has been returned to the factory. The compressor should be returned in the same container used for shipping to the job. The possible damage causes or conditions that were found must be recorded by marking the compressor return tag.

CAUTION

Risk of high-pressure refrigerant leakage. Can cause environmental pollution and personal injury.

Do not loosen any refrigeration or electrical connections before relieving pressure.

NOTE
Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

1. Disconnect power.
2. Attach suction and discharge gauges to access fittings.
3. Recover refrigerant using approved recovery procedures and equipment. Use a filter drier when charging the system with recovered refrigerant.
4. Unsweat refrigerant connections and disconnect electrical connections.
5. Remove failed compressor.
6. Install replacement compressor and make all connections.
7. Pressurize and leak test the system.
8. Follow manufacturer's instructions for cleanout kits.
9. Evacuate the system twice to a minimum 250 microns, breaking the vacuum with dry nitrogen each time. The third time, evacuate to 250 microns and verify the above levels are maintained for at least one minute after the unit is isolated by a shutoff valve from the vacuum pump.
10. With the system in a 250 micron or lower vacuum, charge the system with liquid refrigerant based on requirements of the evaporator, condensing unit and lines. Refer to **2.5.6 - General System Charge Requirements** or unit nameplate for system charge requirements.
11. Apply power and operate system. Check for proper operation. Refer to design pressures in **Table 13**.

4.4 Field Charge Verification

An integral sight glass is provided with the receiver to assist in field charge verification. During charge verification set the control temperature down to keep the system running. If the system is equipped with hot gas bypass, de-energize it by removing power from the hot gas solenoid valve coil. To remove power, disconnect the solenoid leads from the unit contactor in the electric box (refer to specific unit schematic; reference Figures 7 through 10). When charge verification has been completed, replace and secure all wire connections and covers.

During operation at design ambients (95 or 105°F; 35 or 41°C) the charge level will be above the sight glass in the receiver. If levels are below the sight glass an undercharge condition is likely. If levels are above the sight glass and higher discharge pressures than normal are observed an overcharge condition may be likely. However, verify that other high discharge pressure causes such as dirty coil and restricted airflow are not responsible before removing charge.

At temperatures below design ambient, refrigerant backs into the condenser coil and the level in the receiver will drop below the sightglass. If you are trying to verify charge level at lower ambients, block the condenser coil to maintain 230psig (1585kPa) discharge pressure to ensure the head pressure control valve is closed. At these conditions the charge level should be above the sight glass in the receiver.

NOTE

The 5-ton high ambient, 5-ton Quiet-Line and 8-ton models consist of two condenser coils and two receivers. When restricting airflow on these units, the coils should be blocked off proportionally. If one coil is restricted significantly more than the other, liquid can remain in the restricted coil causing lower levels in the receivers. The receiver liquid level should be above the sight glasses in both receivers. There may be some variation in charge level between the two receiver sight glasses due to piping and assembly variations. When adding charge, determine which receiver level is lower and use that sight glass to gauge charge level.

NOTE

*If no level is visible in the sight glass, add charge until the level is in the middle of the sight glass. Check the discharge pressure during this procedure and adjust coil restrictions to maintain 230 psig (1585 kPa). Once the charge is in the middle of the sight glass, add additional system charge per **Table 22**. After charging, unblock the coil and allow the unit to operate normally. After conditions have stabilized, restrict the coil if required to maintain 230psig (1585kPa) discharge pressure and verify that the charge level is above the sight glass.*

Table 22 Field verification charge

Model Numbers		R-407C
60Hz	50Hz	oz (kg)
PFH014A-_L	—	4 (0.11)
PFH020A-_L	—	
PFH027A-_L	—	
PFH027A-_H	—	18 (0.51)
PFHZ27A-_L	—	
PFH037A-_L	PFH036A-_L	
PFH042A-_L	PFH041A-_L	
PFH037A-_H	PFH036A-_H	8 (0.23)
PFHZ37A-_L	PFHZ36A-_L	
PFH042A-_H	PFH041A-_H	
PFHZ42A-_L	PFHZ41A-_L	
PFH067A-_L	PFH066A-_L	18 (0.51)
PFH067A-_H	PFH066A-_H	50 (1.42)
PFHZ67A-_L	PFHZ66A-_L	
PFH096A-_L 3-ton circuit 5-ton circuit	PFH095A-_L 3-ton circuit 5-ton circuit	18 (0.51) 18 (0.51)

5.0 TROUBLESHOOTING

Table 23 Troubleshooting

Problem	Cause	Remedy
Unit will not start	No power to unit	Check voltage at input terminal block.
	Compressor contactor not pulling in	Check for 24VAC ±2VAC at control connections 1 & 2. If no voltage, check control setting requires cooling. If there is voltage, lockout relay may be energized. Check for 24VAC at control connections 2 & 3. If there is voltage, see compressor high-discharge pressure/lockout relay.
	Control voltage circuit breaker (at transformer in evaporator module) open	Locate short and reset circuit breaker.
	Short cycle prevention control	Control software delays compressor 3 minutes from stop to start.
	Compressor high discharge pressure/ lockout relay	Check for 24VAC ±2VAC at control connections 2 & 3. Remove 24VAC signal at Connection 2 by turning indoor unit control off, then back on, or by raising the setpoint to remove the cab for cooling, then resetting to re-establish operation.
High discharge pressure	Insufficient air flow across condenser coil	Check fan operation. Remove debris from coil and air inlets.
	High refrigerant charge	Check refrigerant charge.
Low discharge pressure	Faulty head pressure control valve	Replace if defective.
	Compressor rotation in reverse direction	Check for proper power phase wiring to unit and to compressor motor.
Low suction pressure / compressor cycling	Insufficient refrigerant in system	Check for leaks; repair and add refrigerant.
	Plugged filter drier	Replace filter drier.
	Improper superheat adjustment	Reset expansion valve for 10-15°F (5.6 to 8.4°C) superheat at evaporator.
	Defective liquid line solenoid valve	Check valve and coil; replace if necessary.
Low compressor capacity/ no cooling	Defective liquid line solenoid valve	Check valve and coil; replace if necessary.
	Plugged filter drier	Check pressure drop across filter drier. Replace filter drier.
	Low refrigerant charge	Check for normal system operating pressures. Refer to abnormal pressure causes if applicable. Check for leaks. Proper refrigerant charge is very important at low ambient operation.
Compressor noisy	Loose compressor or piping support	Tighten clamps.
	Compressor rotation in reverse direction	Check for proper power phase wiring to unit and to compressor motor.
Pipe Rattle	Loose pipe connections	Check pipe connections.
Compressor running hot	Compression ratio too high	Check for normal system operating pressures. Refer to abnormal pressure causes if applicable.
Compressor motor protectors tripping or cycling	High discharge pressure	Check for blocked condenser fan or coil.
	High suction temperature	Check expansion valve and hot gas bypass valve setting. Check liquid quenching valve operation.
	Loose power or control circuit wiring connection	Check all power and control circuit connections.
	Defective motor	Check for motor ground or short. Replace compressor if either condition is found.
Compressor cycles on locked rotor	Low line voltage	Check line voltage and determine location of voltage drop.
	Compressor motor defective	Check for motor winding short or ground.
	Single phasing	Check voltage across all 3 legs at contactor. Correct source of problem.
Motor burnout	Check control panel for welded contactor contacts or welded overload contacts.	Replace defective components.

Technical Support / Service

Web Site
www.liebert.com
Monitoring
liebert.monitoring@emerson.com
800-222-5877
Outside North America: +00800 1155 4499
Single-Phase UPS & Server Cabinets
liebert.upstech@emerson.com
800-222-5877
Outside North America: +00800 1155 4499
Three-Phase UPS & Power Systems
800-543-2378
Outside North America: 614-841-6598
Environmental Systems
800-543-2778
Outside the United States: 614-888-0246

Locations

United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Europe
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257
Asia
29/F, The Orient Square Building
F. Ortigas Jr. Road, Ortigas Center
Pasig City 1605
Philippines
+63 2 687 6615
Fax: +63 2 730 9572

SL-10059_REV8_10-13

Emerson Network Power
Division: Liebert
Web: www.emerson.com